Geophysical Research Abstracts
Vol. 18, EGU2016-17930-1, 2016
EGU General Assembly 2016

Remote sensing and spatially distributed erosion models as a tool to really understand biocrust effects on soil erosion

Emilio Rodriguez-Caballero (1,2), Sonia Chamizo (3), Raul Román (2), Beatriz Roncero (2), Bettina Weber (1), Victor Jetten (4), and Yolanda Cantón (2)

(1) Max Planck Institute for Chemistry, Multiphase Chemistry department, Mainz, Germany (e.rodriguez-caballer@mpic.de), (2) Departamento de Agronomía. Universidad de Almería. La Cañada de San Urbano. Almería, (Spain)., (3) Applied Physics Department, University of Granada, Granada, Spain, (4) Faculty of Geoinformation Science and Earth Observation (ITC), University of Twente, The Netherlands

Since publication of the first Ecological Stides volume on biological soil crusts (biocrusts) in 2003, numerous studies have been conducted trying to understand the role of biocrusts in runoff generation and water erosion. Most of them considered these communities as one of the most important stabilizing factors dryland regions. However, these studies were concentrated only on patch or hillslope scales, and there is a lack of information on biocrust interactions with other surface components at catchment scale. Even on fine textured soils, where biocrusts increase water infiltration, they act as runoff source when compared to vegetation. Run-on from biocrusted areas may be harvested by downslope vegetation, but sometimes it may promote downslope erosion. Thus, to really understand the effect of biocrusts on soil erosion, studies on larger scales, preferably on a catchment scale are needed.

For this we developed a new approach, based on field measurements and remote sensing techniques, to include biocrust effects in physically-based runoff and erosion modeling. Doing this we were able to analyze how runoff generated in biocrust areas is redistributed within the landscape and its effect on catchment water erosion. The Limburg Soil Erosion Model (LISEM) was used to parameterize and simulate the effects of biocrusts on soil erosion in a small badlands catchment, where biocrusts represent one of the main surface components. Biocrust stability and cohesion were measured in the field, their hydrological properties were obtained from runoff plots, and their cover and spatial distribution was estimated from a hyperspectral image by linear mixture analysis. Then, the model was run under different rainfall intensities and final runoff and erosion rates were compared with field data measured at the catchment outlet. Moreover, these results were compared with the hypothetical scenario in which biocrusts were removed, simulating human disturbances or climatic change effects on biocrusts cover.

Our results showed that most of the runoff generated in biocrust dominated areas is re-infiltrated in downstream vegetation. However, when biocrusts were removed, as in the case of human disturbance, runoff generation increased considerably in those areas. This led to the saturation of vegetated buffers, increasing catchment connectivity and water erosion. Thus we may conclude that the proposed approach enables us to include biocrusts in spatially distributed runoff and erosion models, which can be used to understand their real role in soil erosion at catchment scale, but also to evaluate the effect of human activity and global change on catchment-scale water erosion.